

IN THE CLAIMS:

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1. A taut mooring system for a jack-up platform which includes jacking mechanisms for raising the hull of the jack-up above the surface of a body of water, comprising mooring line connections that are radially spaced in plan on the extremities of the hull; anchors that are radially spaced around the jack-up consistent with the radial spacing of the connections; taut mooring lines that are radially attached between the anchors and the connections, and a tensioning system for the mooring lines.
 2. The invention of claim 1, wherein said mooring line connections are attached to the hull of the jack-up and the tensioning system comprises the existing jacking mechanisms used to raise the hull of the jack-up above the surface of the water.
 3. The invention of claim 2 wherein said jacking mechanisms comprise pinion gear drives mounted to the hull working in combination with one or more gear racks fixed to each leg.
 4. The invention of claim 1 wherein said radially spaced mooring lines comprise a single line extending from each hull extremity of said jack-up, and wherein said lines are radially aligned approximately with the center point of the jack-up and disposed on approximately equal angles one from another.
 5. The invention of claim 1 wherein said radially spaced mooring lines comprise multiple lines extending in sets from each hull extremity of said jack-up, and wherein said lines are symmetrically disposed in extending from each extremity of said jack-up so that the resultant forces from the combination of each set of multiple lines at each extremity are radially aligned approximately with the center point of the jack-up and disposed on approximately equal angles one from another.

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6. The invention of claim 2 wherein said radially spaced mooring lines comprise multiple lines extending in sets from each hull extremity of said jack-up, and wherein said lines are symmetrically disposed in extending from each extremity of said jack-up so that the resultant forces from the combination of each set of multiple lines at each extremity are radially aligned approximately with the center point of the jack-up and disposed on approximately equal angles one from another.

7. The invention of claim 1 wherein said anchors are suction piles.

8. The invention of claim 2 wherein said anchors are suction piles.

9. The invention of claim 4 wherein said anchors are suction piles.

10. The invention of claim 5 wherein said anchors are suction piles.

11. The invention of claim 6 wherein said anchors are suction piles.

12. The invention of claim 1 wherein said mooring lines are kevlar cables.

13. The invention of claim 2 wherein said mooring lines are kevlar cables.

14. The invention of claim 4 wherein said mooring lines are kevlar cables.

15. The invention of claim 5 wherein said mooring lines are kevlar cables.

16. The invention of claim 6 wherein said mooring lines are kevlar cables.

17. The invention of claim 1 wherein said mooring lines are connected between said anchors and said jack-up at an angle within the range of 20 degrees to 40 degrees from the horizontal.

18. The invention of claim 2 wherein said mooring lines are connected between said anchors and said jack-up at an angle within the range of 20 degrees to 40 degrees from the horizontal.

19. The invention of claim 4 wherein said mooring lines are connected between said anchors and said jack-up at an angle within the range of 20 degrees to 40 degrees from the horizontal.

20. The invention of claim 5 wherein said mooring lines are connected between said anchors and said jack-up at an angle within the range of 20 degrees to 40 degrees from the horizontal.
21. The invention of claim 6 wherein said mooring lines are connected between said anchors and said jack-up at an angle within the range of 20 degrees to 40 degrees from the horizontal.
- 5 22. The invention of claim 1 wherein said tensioning system comprises an auxiliary jacking unit for use with each leg of the jack-up and wherein said mooring line connections are attached to said auxiliary jacking units to function as the tensioning system for said mooring lines.
23. The invention of claim 22 wherein said jacking mechanisms comprise pinion gear drives mounted to the hull working in combination with one or more gear racks fixed to each leg.
- 10 24. The invention of claim 22 wherein said radially spaced mooring lines comprise a single line extending from each leg of said jack-up, and wherein said lines are approximately radially aligned with the center point of the jack-up and disposed on approximately equal angles one from another.
- 15 25. The invention of claim 22 wherein said radially spaced mooring lines comprise multiple lines extending in sets from each leg of said jack-up, and wherein said lines are symmetrically disposed in extending from each leg of said jack-up so that the resultant forces from the combination of each set of multiple lines at each leg are approximately radially aligned with the center point of the jack-up and disposed on equal angles one from another.
- 20 26. The invention of claim 22 wherein said anchors are suction piles.
27. The invention of claim 23 wherein said anchors are suction piles.
28. The invention of claim 24 wherein said anchors are suction piles.
29. The invention of claim 25 wherein said anchors are suction piles.
30. The invention of claim 22 wherein said mooring lines are kevlar cables.

31. The invention of claim 23 wherein said mooring lines are kevlar cables.
32. The invention of claim 24 wherein said mooring lines are kevlar cables.
33. The invention of claim 25 wherein said mooring lines are kevlar cables.
34. The invention of claim 22 wherein said mooring lines are connected between said anchors
5 and said jack-up at an angle within the range of 20 degrees to 40 degrees from the horizontal.
35. The invention of claim 23 wherein said mooring lines are connected between said anchors
and said jack-up at an angle within the range of 20 degrees to 40 degrees from the horizontal.
36. The invention of claim 24 wherein said mooring lines are connected between said anchors
and said jack-up at an angle within the range of 20 degrees to 40 degrees from the horizontal.
- 10 37. The invention of claim 25 wherein said mooring lines are connected between said anchors
and said jack-up at an angle within the range of 20 degrees to 40 degrees from the horizontal.
38. The invention of claim 22 further comprising connections for linking said auxiliary jacks to
said hull wherein said auxiliary jacks can be used to increase the jacking capacity of the jack-
up when elevating the hull above the surface of the body of water.
- 15 39. The invention of claim 23 further comprising connections for linking said auxiliary jacks to
said hull wherein said auxiliary jacks can be used to increase the jacking capacity of the jack-
up when elevating the hull above the surface.
40. The invention of claim 24 further comprising connections for linking said auxiliary jacks to
said hull wherein said auxiliary jacks can be used to increase the jacking capacity of the jack-
up when elevating the hull above the surface.
- 20 41. The invention of claim 25 further comprising connections for linking said auxiliary jacks to
said hull wherein said auxiliary jacks can be used to increase the jacking capacity of the jack-
up when elevating the hull above the surface of the body of water.

42. A method of expanding the safe working area of operation, increasing the maximum operating water depth limit, increasing the fatigue life, increasing the service life, and/or increasing the severity of the environmental criteria that an existing jack-up is capable of resisting comprising: designing a taut mooringsystem of mooring lines, anchors, mooring line connections, and a tensioning system for the mooring lines for the jack-up; making a study of the location site conditions; analyzing the performance of the jack-up in a taut moored condition under the environmental conditions expected at the site of intended operation; and, estimating the remaining fatigue.

43. The method of claim 42 wherein the step of analyzing the performance of the jack-up comprises a static analysis.

44. The method of claim 42 wherein the step of analyzing the performance of the jack-up comprises a dynamic analysis.

45. The method of claim 42 wherein the step of analyzing the performance of the jack-up comprises a fatigue analysis.

46. The method of claim 42 wherein the step of analyzing the performance of the jack-up under the conditions expected at the site comprises the step of evaluating the jack-up's leg stresses, storm holding forces of the elevating pinions of the jacking system, storm holding forces of any leg to hull locking system, leg footing reactions to the soil, the required preload ballast, and resistance to overturning.

47. A method of expanding the safe working area of operation, increasing the maximum operating water depth limit, increasing the fatigue life, increasing the service life, and/or increasing the severity of the environmental criteria that

a new jack-up design is capable of resisting comprising: designing a taut mooring system of mooring lines, anchors, mooring line connections, and a tensioning system for the mooring lines for the jack-up; and analyzing the performance of the jack-up in a taut moored condition